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|---|---|
| f | **Fermi National Accelerator Laboratory**<br>**Batavia, IL 60510** |

# CMS ME1/3 CATHODE INNER PANEL FR-4 BAR GLUING TRAVELER

## Reference Drawing(s)
## Endcap Muon Chamber ME1/3 Final Assembly 5520-ME-368130

## Endcap Muon Chamber ME1/3 Inner Cathode Panel Assembly 5520-ME-368133

| | |
|---|---|
| **Budget Code:** | **Project Code:** |
| **Released by:** | **Date:** |

**Prepared by:** M. Hubbard, B. Jensen, L. Lee

| Title | Signature | Date |
|---|---|---|
| **TD / E&F Process Engineering** | **Bob Jensen/Designee** | |
| **TD / E&F CMS Assembly** | **Glenn Smith/Designee** | |
| **TD / E&F Technological Physicist** | **O. Prokofiev/Designee** | |
| **TD / CMS Project Manager** | **G. Apollinari/Designee** | |

**Revision Page**

| Revision | Step No. | Revision Description | TRR No. | Date |
|---|---|---|---|---|
| None | N/A | Initial Release | N/A | 05/16/00 |

**Ensure appropriate memos and specific instructions are placed with the traveler before issuing the sub traveler binder to production.**

1.0 General Notes

1.1 White (Lint Free) Gloves (Fermi stock 2250-1800) or Nitrile Gloves (Fermi stock 2250-2040) or equivalent, shall be worn by all personnel, as required, when handling all product parts after the parts have been prepared/cleaned.

1.2 All steps that require a sign-off shall include the Technician/Inspectors first initial and full last name.

1.3 No erasures or white out will be permitted to any documentation. All incorrectly entered data shall be corrected by placing a single line through the error, initial and date the error before adding the correct data.

1.4 All Discrepancy Reports issued shall be recorded in the left margin next to the applicable step.

1.5 All personnel performing steps in this traveler must have documented training for this traveler and associated operating procedures.

1.6 Personnel shall perform all tasks in accordance with current applicable ES&H guidelines and those specified within the step.

1.7 Cover the panel/chamber with Mylar when not being serviced or assembled.

1.8 Never hand pass anything over a panel as dropped items may damage the panel.

2.0 Parts Kit List

2.1 Attach the completed Parts Kit List for the CMS Cathode Inner Panel Gluing to this traveler. Ensure that the serial number on the Parts Kit List matches the serial number of this traveler. Verify that the Parts Kit received is complete.

_____ _____

Process Engineering/Designee Date

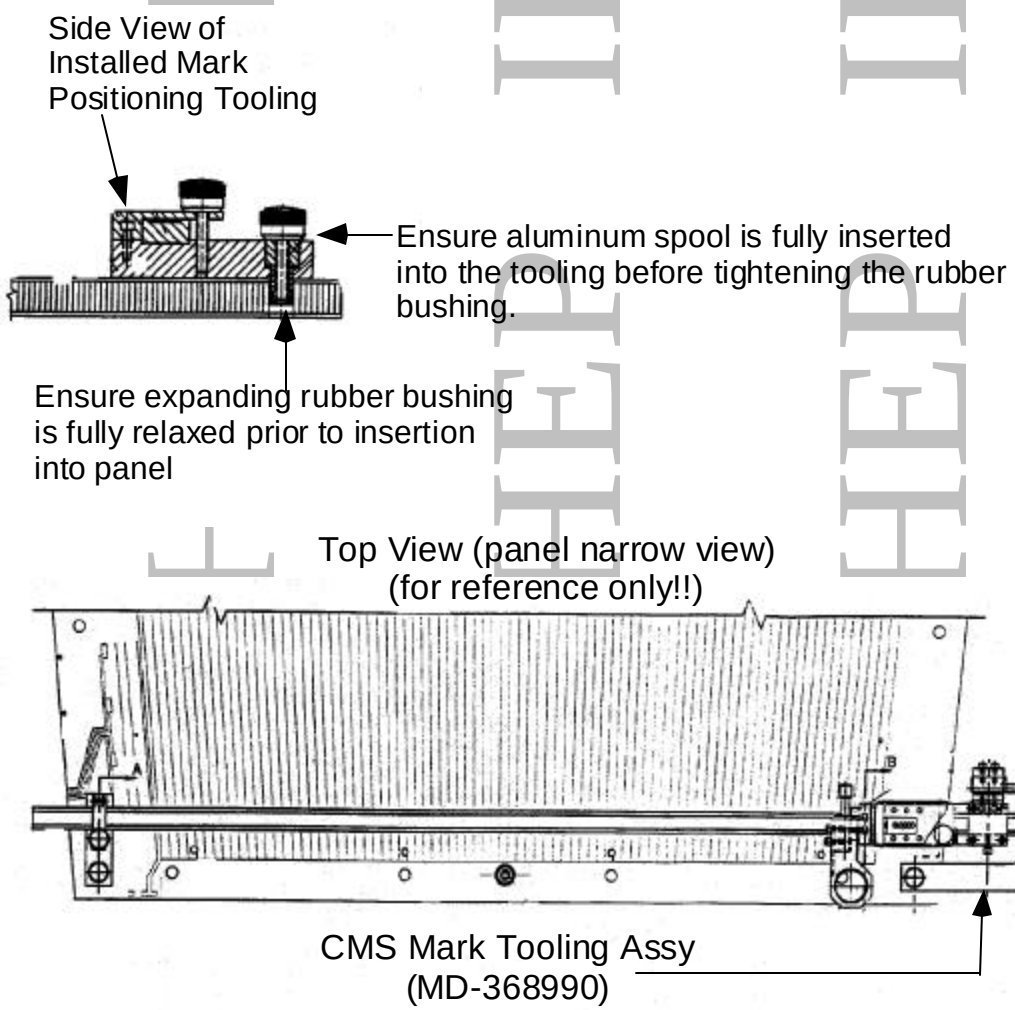
3.0 Panel Preparation (Side 1)

Completed

3.1 Acquire the Cathode Inner Panel (ME-368133) as per the Panel Serial Number at the bottom of this traveler. ❒

3.2 Clean the entire panel with Ethyl Alcohol (Fermi Stk. No. #1920-0600) and a low-lint wipe (Fermi Stk No. 1660-2500) to remove any dirt, dusts, oils, and other foreign material on the panel. ❒

3.3 Install the Mark Position Measuring Device Assembly (MD-368990) onto the panel. When installing the Mark Positioning Tooling, ensure the expanding bushing is fully relaxed before installing into the panel. Also, ensure the aluminum spool is fully inserted into the tooling before tightening the rubber bushing. ❒



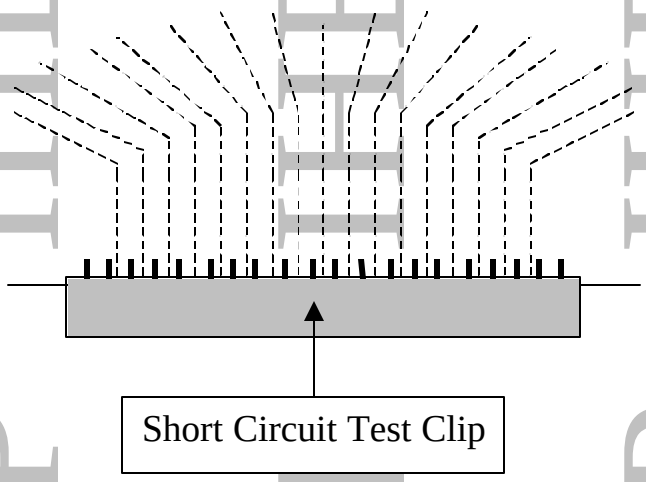

3.4 Measure the panel and record the measurements on Measurement Form 5520-FM-333524 and attach the completed form to this traveler. ❒

Technician(s) _____ Date _____

3.5 Using two Short Circuit Tester Units, check all four strip connector circuits. Starting from the left of the serial number, place a Short Circuit Tester on Circuits #1 and #2. ❒

**Note(s):**

**Ensure there are two prongs on each side of the outer strips as shown in the diagram.**



3.6 If no RED or GREEN lights activate, then continue checking the balance of the circuits as per below chart.

| Circuit | Pass | Fail |
|---|---|---|
| Circuit #1 + Circuit #2 | | |
| Circuit #2 + Circuit #3 | | |
| Circuit #3 + Circuit #4 | | |

**Note(s):**

**After measurements are completed inform supervisor of any failures.**
**If all pass continue**

_____ _____
Technician(s) Date

**X** 3.7 Panel has passed all circuit testing and is acceptable for further processing.

_____ _____
Lead Person Date

3.8 Acquire FR-4 Isolation Strips (MA-368446 [4ea]) and clean with Ethyl Alcohol (Fermi Stk No. 1920-0600) and a low-lint wipe (Fermi Stk No. 1660-2500). ❒

3.9 Acquire the following gap bars; (MA-368440 [2 ea], MA-368442 [2 ea], MA-368443 [2 ea,], and MA-368444 [2 ea]) and Gas Sleeves (Ma-368305 [5 ea]) and clean with Ethyl Alcohol (Fermi Stk. No. #1920-0600) and a low-lint wipe (Fermi Stk No.1660-2500) to remove any dirt, dusts, oils, and other foreign material. Clean out the grooves in the gap bars with cotton swabs dipped in the ethyl alcohol. ❒

3.10 Load one gap bar into the tape installation machine (or if preferred, affix gap bar with Adhesive tape by hand) and affix 3M Scotch double side adhesive tape (F9469 PC) to the back of the gap bar. Trim both ends to fit. Trim out the holes and trim the tape where there is overlap on the side of the gap bars. Continue until all gap bars are completed. ❒

_____ _____
Technician(s) Date

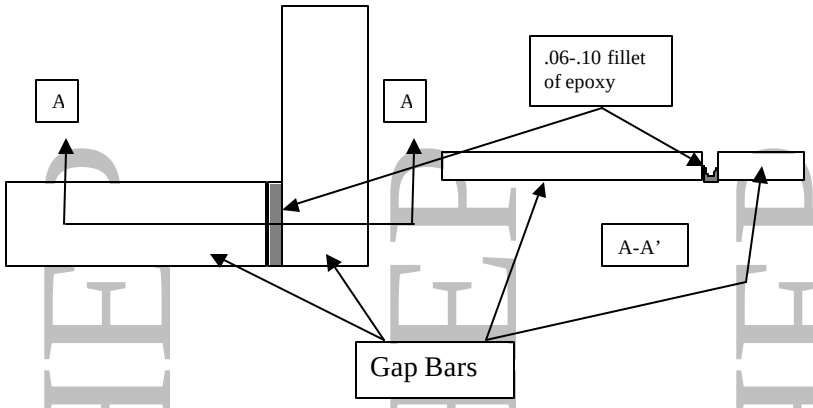
Completed

3.11 Mix glue (Epoxy Adhesive #2216 Parts A&B) in a 50/50 ratio using approximately 50 grams of each. Allow the glue to sit for at least 30 minutes and no more than 45 minutes. ❒

3.12 Without removing the protective strip, align the gap bars along the panel. Install the pins (MA-368941) through the holes in the gap bar and into panel to make sure the gap bar holes and panel holes align. ❒

3.13 Remove Gap Bars from the panel and remove the adhesive tape protective strip. ❒

3.14 Apply glue (Epoxy Adhesive #2216 Translucent) with a small brush to all the interfacing ends of the gap bars to create a fillet between the Gap Bar and the panel copper. Realign the gap bars onto the pins. Continue installing gap bars in this way until all gap bars are installed onto the panel. Ensure all alignment pins are removed from the gap bars once they are correctly taped in place. ❒




**Note(s):**

**Panels must be glued and clamped the same day the Gap Bars are installed!**

**During the installation of the gap bars, ensure correct placement of the gap bars as per the angle cut on the gap bar ends.**

**During the installation of the gap bars, visually check all four corners to ensure proper fit of gap bar interfaces.**

**Ensure the panel is covered with Mylar when the panel is not being serviced**

3.15 Install the gas sleeves into the gas sleeve holes on the wide end of the panel. ❒

_____ _____

Technician(s) Date

Completed

3.16 Using a 10X magnifier, examine the four alignment grooves on the Strip Side of the panel to ensure they are clean. Two at the wide end and two at the narrow end. ❒

3.17 Locate the Retro-Reflective Target's (MA-368100) shaft into the alignment groove and push it flush to the panel. ❒

3.18 Using a knife edge or similar tool place pressure on the top center of the shaft, visually examine using the 10X magnifier that the shaft is nesting into the groove perfectly. ❒

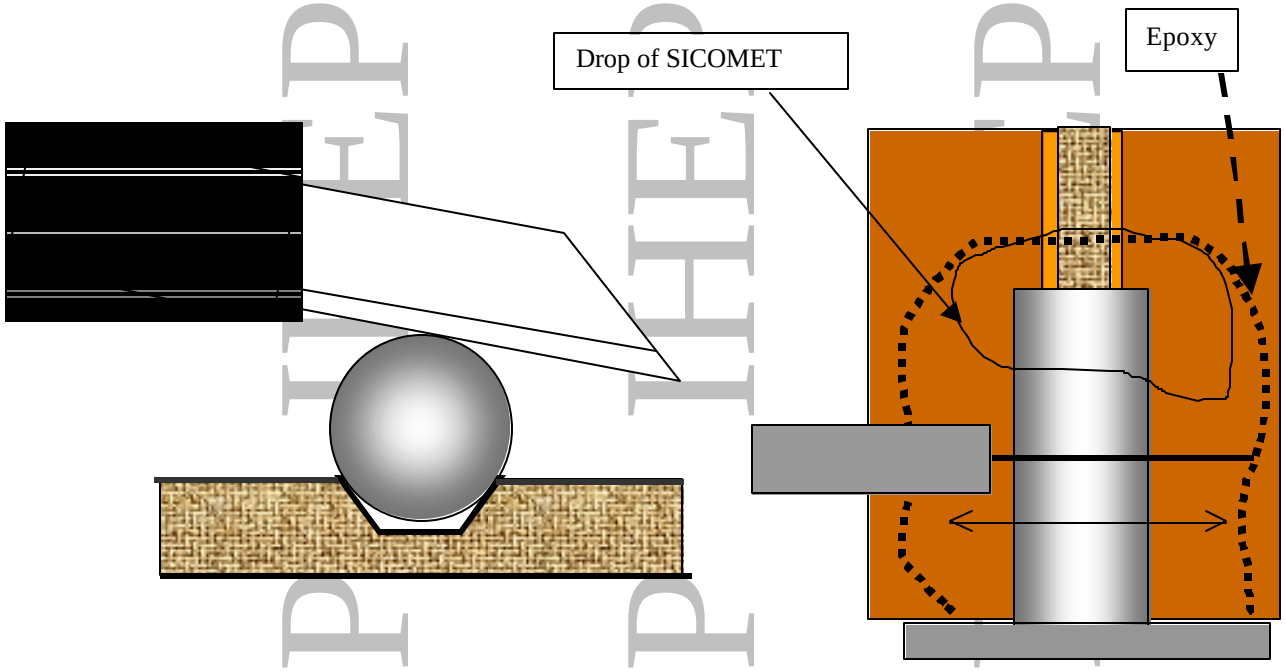
3.19 Keeping pressure on the shaft, put one drop of Sicomet (XXXXXX) on the shaft as in the drawing below. Hold pressure for 30 seconds to let the Sicomet cure. ❒

3.20 Remove the knife and apply epoxy (MA-368288) over the shaft as in the drawing below. ❒

**Note(s):**

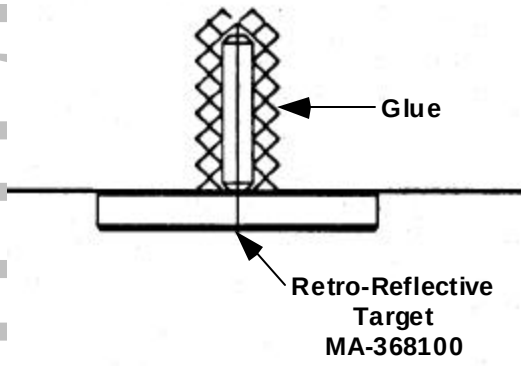
**Ensure no glue gets on the surface of the retro-reflective dot.**

3.21 Attach the rest of the Targets onto the panel in the same manner according to Dwg 368133. ❒




Technician(s) _____ Date _____

**X** 3.22 The below drawing is typical of a correctly installed Retro-Reflective Target (MA-368100). Verify that all installed Targets are installed correctly.




Lead Person _____ Date _____

4.0 Panel Preparation (Side 2)

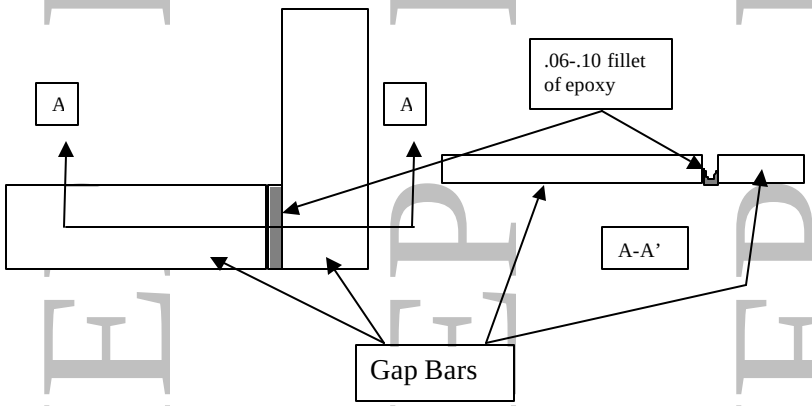
Completed

4.1 Rotate the panel 180° so the opposite side faces up. ❒

4.2 Without removing the protective strip, align the gap bars along the panel. Install the pins (MA-368941) through the holes in the gap bar and into panel to make sure the gap bar holes and panel holes align. ❒

4.3 Remove Gap Bars from the panel and remove the adhesive tape protective strip. ❒

4.4 Apply glue (Epoxy Adhesive #2216 Translucent) with a small brush to all the interfacing ends of the gap bars to create a fillet between the Gap Bar and the panel copper. Realign the gap bars onto the pins. Continue installing gap bars in this way until all gap bars are installed onto the panel. Ensure all alignment pins are removed from the gap bars once they are correctly taped in place. ❒




**Note(s):**

**Panels must be glued and clamped the same day the Gap Bars are installed!**

**During the installation of the gap bars, ensure correct placement of the gap bars as per the angle cut on the gap bar ends.**

**During the installation of the gap bars, visually check all four corners to ensure proper fit of gap interfaces.**

**Ensure the panel is covered with Mylar when the panel is not being serviced**

_____ _____

Technician(s) Date

5.0 Panel Gluing (Side 1)

Completed

**Note(s):**

**The gluing of the Cathode Panels requires two days. On one day, one Upper and two Inner Panel sides will be glued. On the following day, one Lower and the other two sides of the Inner Panels will be glued.**

5.1 Transport the Cathode Inner Panel with gap bars installed to the Panel Gluing Table. Install the Cathode Panel onto the Gluing Table work surface and pin the panel into position. ❒

5.2 Apply a piece of Scotch tape (Fermi Stk. No. #1365-10400) to all the seams of the already applied gap bars to prevent the glue from seeping out. Put a small visible mark with a marker on the piece of scotch tape to ensure the tape is removed, once the epoxy is cured. ❒

5.3 Using a syringe, apply glue (Epoxy Adhesive #2216 Translucent) to the isolation strip areas. Install the Isolation Strips onto panel in proper position over the glue and work the epoxy toward the outer edges of the Isolation Strips. ❒

5.4 Using a syringe, apply glue (Epoxy Adhesive #2216 Translucent) to the inside perimeter of the FR-4 Gap Bars. ❒

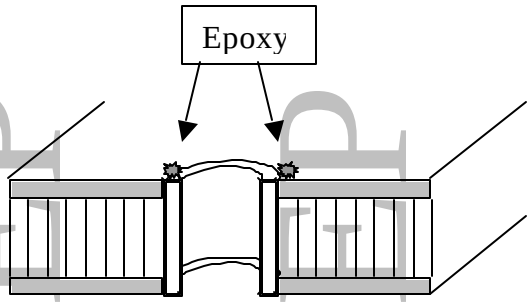
5.5 Using a syringe, apply glue (Epoxy Adhesive #2216 Translucent) to the outside perimeter of the FR-4 Gap Bars. ❒

5.6 Apply a small amount of epoxy to the outer edge of the gas sleeves to fill the gap between the sleeve and panel hole. ❒

**Note(s):**

**Ensure that the gas sleeve through hole remains free of epoxy during this procedure**

**Ensure the gas sleeves are settled properly within the gas sleeve holes before applying the epoxy.**




Technician(s) _____ Date _____

6.0 Panel Staging (Side 1)

Completed

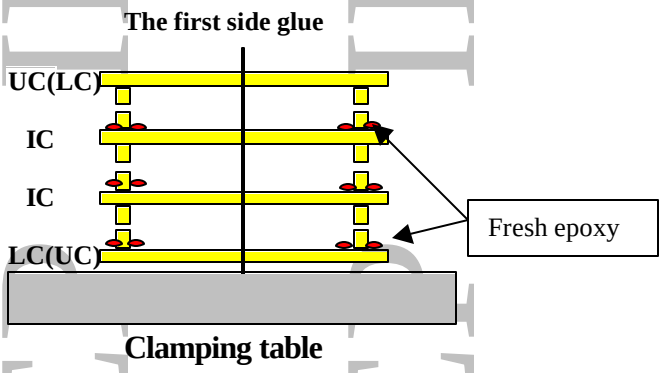
6.1 Remove the alignment pins from the Cathode Inner Panel. ❒

6.2 Transport the Cathode Inner Panel with Gap Bars and fresh epoxy to the Cathode Panel Curing Staging Area. ❒

6.3 Set the Panel on the Cathode curing table. Panel order will be in accordance with the drawing. Install technological alignment pins (McMaster-Carr 90139A134). ❒

**Note(s):**

**Panels with fresh epoxy must be positioned so the fresh epoxy is on the top side of the panel.**



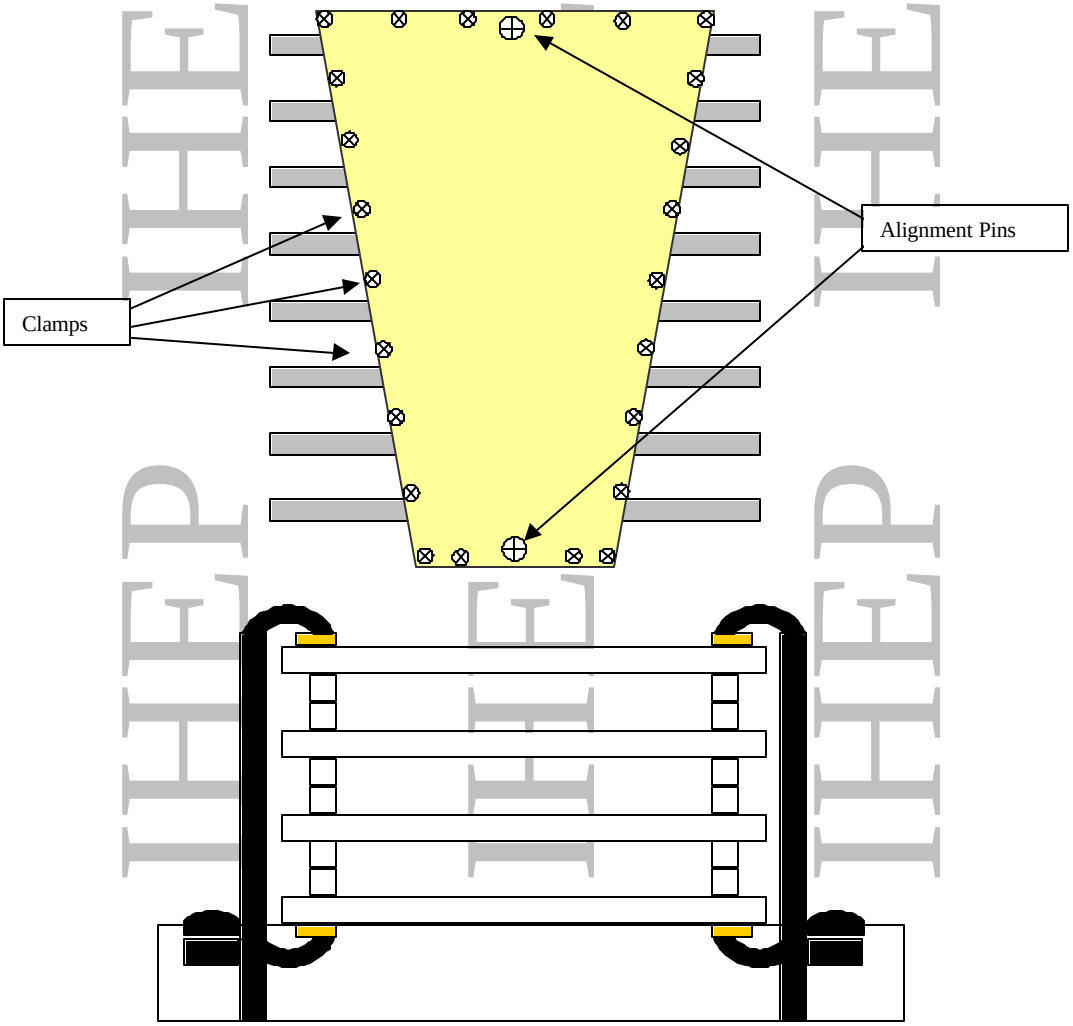

Technician(s) _____ Date _____

Completed

6.4 Positioning the Quick Grip Clamp Bars (McMaster-Carr 5039A74) at 6” intervals directly over the Gap Bars, clamp the panels to the table while the epoxy is curing. ❒

**Note(s):**

**Ensure there is even spacing all around the panels with clamps at each corner.**

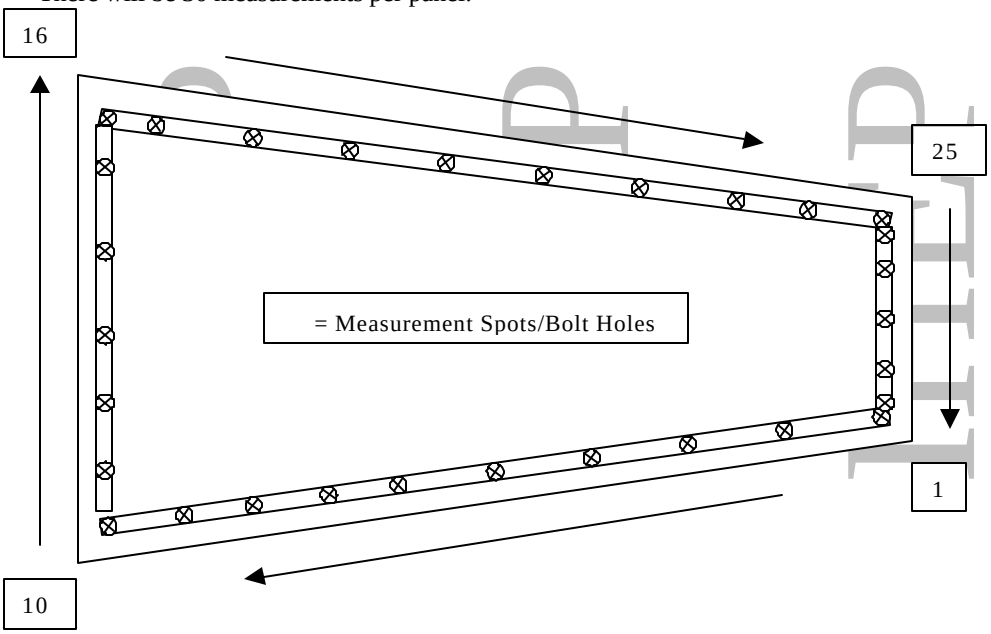



6.5 Once the epoxy has cured (after 24 hrs) remove alignment pins and clamps from panels. ❒

_____ _____

Technician(s) Date

6.6 Using a Depth Micrometer measure the height of Gap bars from the panel surface. Measurements will be taken on the outside of the Gap bar close to the bolt holes. There will be 30 measurements per panel.




**Acceptable Gap Bar height range: 0.370" to 0.380".**

| Position # | Pass | Fail | Position # | Pass | Fail |
|---|---|---|---|---|---|
| **1** | | | **16** | | |
| **2** | | | **17** | | |
| **3** | | | **18** | | |
| **4** | | | **19** | | |
| **5** | | | **20** | | |
| **6** | | | **21** | | |
| **7** | | | **22** | | |
| **8** | | | **23** | | |
| **9** | | | **24** | | |
| **10** | | | **25** | | |
| **11** | | | **26** | | |
| **12** | | | **27** | | |
| **13** | | | **28** | | |
| **14** | | | **29** | | |
| **15** | | | **30** | | |

**Note(s):**

**After measurements are completed inform supervisor of any failures.**
**If all pass continue.**

**X** 6.7 Panel has passed all Gap Bar Measurements and is acceptable for further processing.

Lead Person

Date

7.0 Panel Gluing (Side 2)

Completed

7.1 Transport the Cathode Inner Panel with one side glued and cured to the Panel Gluing Table and rotate the panel 180° so the side that has NOT been glued faces up. ❒

7.2 Install the Cathode Panel onto the Gluing Table work surface and pin the panel into position ❒

7.3 Apply a piece of Scotch tape (Fermi Stk. No. #1365-10400) to all the seams of the already applied gap bars to prevent the glue from seeping out. Put a small visible mark with a marker on the piece of scotch tape to ensure the tape is removed, once the epoxy is cured. ❒

7.4 Using a syringe, apply glue (Epoxy Adhesive #2216 Translucent) to the isolation strip areas. Install the Isolation Strips onto the panel over the glue and work the epoxy toward the outer edges of the Isolation Strips. ❒

7.5 Using a syringe, apply glue (Epoxy Adhesive #2216 Translucent) to the inside perimeter of the FR-4 Gap Bars. ❒

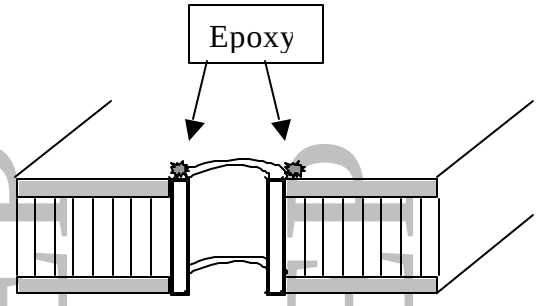
7.6 Using a syringe, apply glue (Epoxy Adhesive #2216 Translucent) to the outside perimeter of the FR-4 Gap Bars. ❒

7.7 Apply a small amount of epoxy to the outer edge of the gas sleeves to fill the gap between the sleeve and panel hole. ❒

**Note(s):**

**Ensure that the gas sleeve through hole remains free of epoxy during this procedure**

**Ensure the gas sleeves are settled properly within the gas sleeve holes before applying the epoxy.**




Technician(s) _____ Date _____

8.0 Panel Staging (Side 2)

Completed

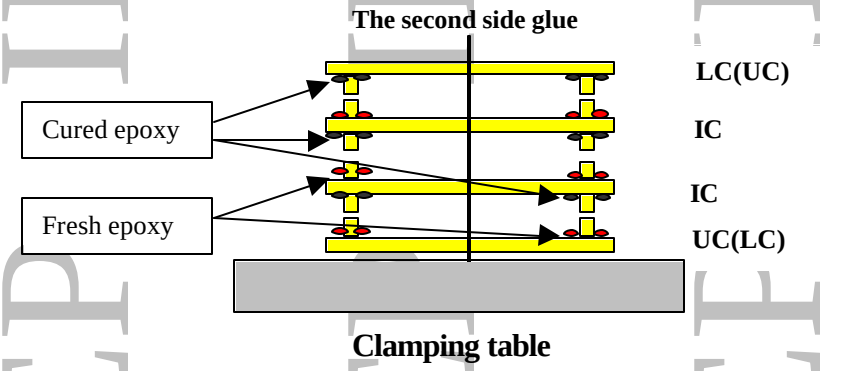
8.1 Remove the alignment pins from the Cathode Inner Panel. ❒

8.2 Transport the Cathode Inner Panel with Gap Bars and fresh epoxy to the Cathode Panel Curing Staging Area. ❒

8.3 Set the Panel on the Cathode curing table. Panel order will be in accordance with the drawing. Install technological alignment pins (McMaster-Carr 90139A134). ❒

**Note(s):**

**Panels with fresh epoxy must be positioned so the fresh epoxy is on the top side of the panel.**



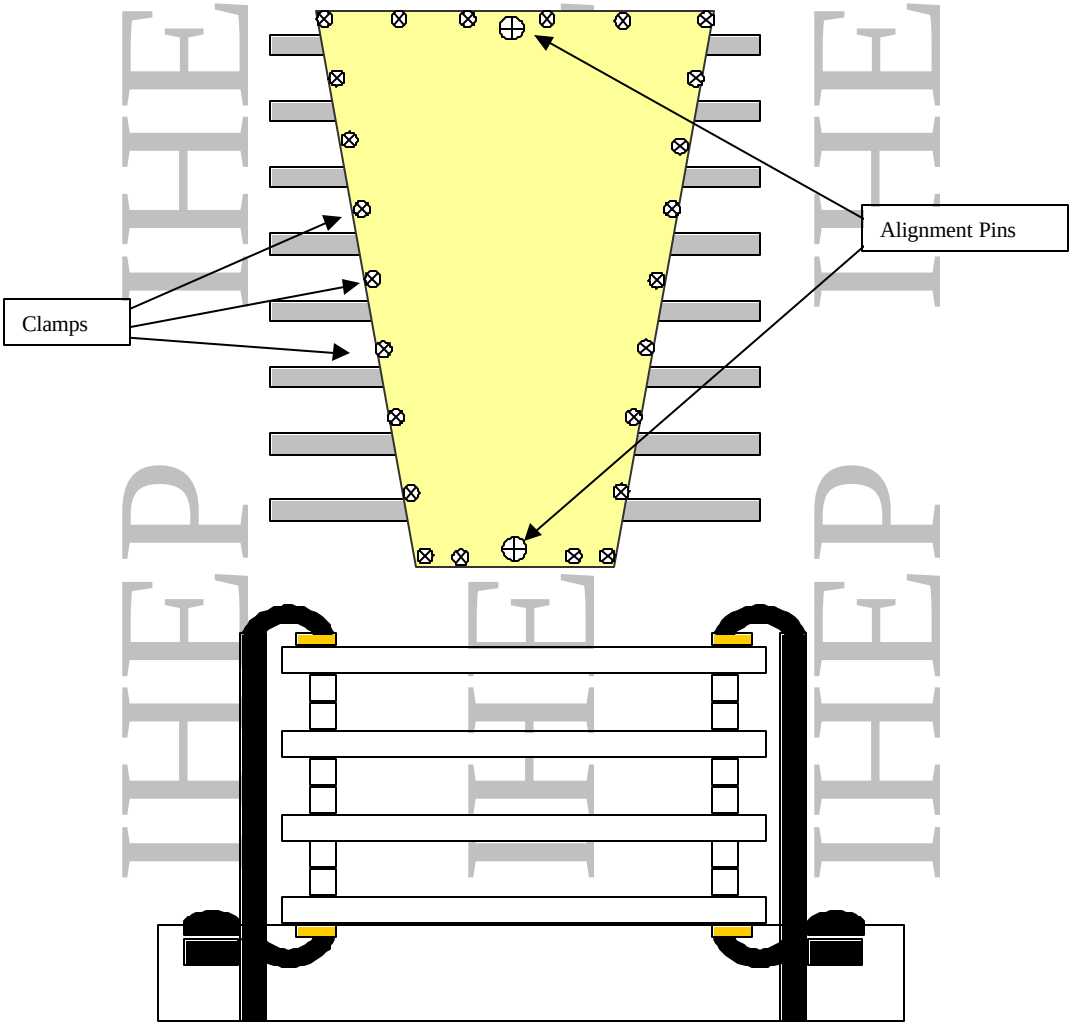

Technician(s) _____ Date _____

Completed

8.4 Positioning the Quick Grip Clamp Bars (McMaster-Carr 5039A74) at 6” intervals, directly over the Gap Bars, clamp the panels to the table while the epoxy is curing. ❒

**Note(s):**

**Ensure there is even spacing all around the panels with clamps at each corner.**

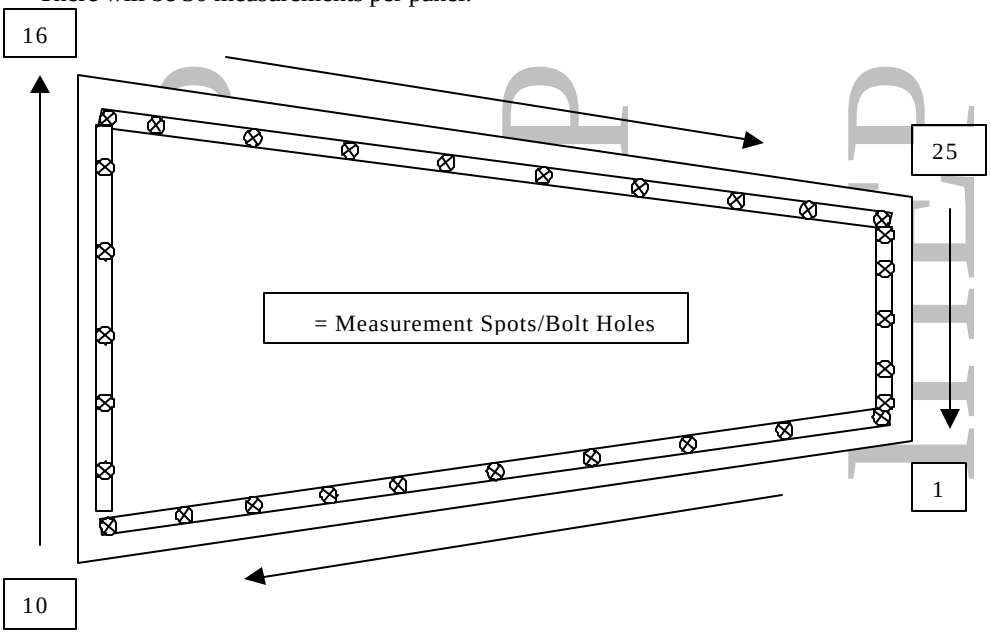



8.5 Once the epoxy has cured (after 24 hrs) remove alignment pins and clamps from panels. ❒

_____ _____

Technician(s) Date

8.6 Using a Depth Micrometer measure the height of Gap bars from the panel surface. Measurements will be taken on the outside of the Gap bar close to the bolt holes. There will be 30 measurements per panel.




**Acceptable Gap Bar height range: 0.370" to 0.380".**

| Position # | Pass | Fail | Position # | Pass | Fail |
|---|---|---|---|---|---|
| 1 | | | 16 | | |
| 2 | | | 17 | | |
| 3 | | | 18 | | |
| 4 | | | 19 | | |
| 5 | | | 20 | | |
| 6 | | | 21 | | |
| 7 | | | 22 | | |
| 8 | | | 23 | | |
| 9 | | | 24 | | |
| 10 | | | 25 | | |
| 11 | | | 26 | | |
| 12 | | | 27 | | |
| 13 | | | 28 | | |
| 14 | | | 29 | | |
| 15 | | | 30 | | |

**Note(s):**

**After measurements are completed inform supervisor of any failures.**
**If all pass continue.**

**X** 8.7 Panel has passed all Gap Bar Measurements and is acceptable for further processing.

_____ _____
Lead Person Date

8.8 Transport the Cathode panel to the Panel Staging Area.

_____ _____
Technician(s) Date

9.0 Production Complete

**XXX** 9.1 Process Engineering verify that the Cathode Inner Panel Traveler (5520-TR-333520) is accurate and complete. This shall include a review of all steps to ensure that all operations have been completed and signed off. Ensure that all Discrepancy Reports, Nonconformance Reports, Repair/Rework Forms, Deviation Index and dispositions have been reviewed by the Responsible Authority for conformance before being approved.

Comments:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Process Engineering/Designee Date

10.0 Attach the Process Engineering "OK to Proceed" Tag on the panel.

Process Engineering/Designee Date

11.0 Proceed to the next major assembly operation as required.